## **Sector Snapshot: Fuel Ethanol**

As more countries mandate the blending of ethanol with gasoline to reduce greenhouse gas emissions in the transportation sector and enhance energy independence, new export opportunities are developing for U.S. fuel ethanol. In terms of total annual volume, the United States was the top exporter of fuel ethanol in the world in 2011 and 2014, and in 2013 essentially shared this distinction with Brazil. Europe was the second largest market for U.S. fuel ethanol from 2010-12, but in the past two years sales to Europe diminished sharply due to the imposition of duties. U.S. fuel ethanol exports have shifted to other markets, particularly Asian countries such as the Philippines and India. However, Canada and Brazil are expected to remain the leading markets for the near term.

Nearly all ethanol is made through a traditional sugar fermentation process with a limited set of biomass-based raw materials (feedstocks), principally corn, other coarse grains (rye and barley), wheat, sugar cane, or sugar beets. A small quantity of ethanol is made via "advanced" conversion technologies (primarily lignocellulosic biomass biochemically converted to alcohols) using wood and agricultural residues (waste streams), municipal solid waste, or dedicated energy crops like popular trees, switch grass, giant cane or energy sorghum.

Roughly 90 billion liters of fuel ethanol was produced annually in 2013-2014. 93 Ethanol trade is growing throughout the world as countries build domestic use through mandates and taxation policy. These policies are motivated by desire to improve energy security by lowering dependence on imported fossil fuels, the need to reduce greenhouse gas emissions or air pollution, and support rural economies.

## **Overview of Global Export Market Opportunities**

Most ethanol consumed in the world today is produced domestically. However, many countries do not have the full production capacity to meet their needs. Despite this, sometimes governments prohibit or impose limitations on the use of foreign fuel ethanol in order to protect their domestic industry. Other times their blend mandates are adjusted according to the domestic capacity available every year. Some countries, such as India and Mexico, have a desire to increase the blending of ethanol with gasoline but infrastructure or political problems prevent their local industry from growing.

Fuel ethanol use has become widespread and the U.S. ethanol industry exports to every region of the world, including to the European Union, where U.S. ethanol exports have faced antidumping duties since 2013. However, for purposes of this report, seven significant markets were not included in the rankings because they were not correlated with domestic biofuels policy,

Figure 1: Fuel Ethanol Exports 2015-2016

Rank		Country	
Strong Prospects	1	<b>Canada</b> Large Market, Large Share	
	2	<b>Brazil</b> Large Market, Large Share	
	3	Philippines Large Market, Large Share	
Less Certain Export Growth	4	India Small Market, Large Share	
	5	<b>Mexico</b> Small Market, Large Share	
	6	<b>Netherlands</b> Small Market, Large Share	
	7	<b>Jamaica</b> Small Market, Large Share	
	8	<b>Peru</b> Small Market, Large Share	
	9	<b>Finland</b> Large Market, Small Share	
Significant Obstacles	10	China Small Market, Large Share	
	11	<b>Colombia</b> Small Market, Large Share	
	12	United Kingdom Large Market, Small Share	

Figure 2: Ethanol Regional Hubs

Country	Region Served	2014 U.S. Fuel Ethanol Exports (L) – U.S. Census Data
UAE	Middle East	258,719,200
Tunisia	Africa	79,393,900
Singapore	Asia/Oceania	43,305,000

the most predictable driving factor. Nevertheless, those markets must be noted as additional opportunities.

Looking at the trade data for U.S. exports in 2012-2014, several markets stand out even though they do not have blend mandates (Figure 2). For these markets, to which we will refer as "regional hubs," it is assumed that the ethanol has a secondary destination. The reasons are varied. The U.S. –produced ethanol may be blended at a refinery and shipped out as a gasoline/ethanol blend to other markets in the region (e.g., the UAE). <sup>94</sup> It is also common to have "discretionary blending" for octane boosting.

Four other markets that saw significant exports in 2014 were not included in the rankings (Figure 3). After some analysis, it was determined that fuel ethanol in Nigeria was in demand mainly for a cooking stove program, not for transportation. Although there is a blend mandate, the Nigerian government encourages domestic ethanol to be used. Since there is no significant ethanol production in Nigeria, it is unlikely the Nigerian government will meet its goal. In the case of Panama, ethanol exports were initially promising in 2014 (and accounted for nearly 100 percent of Panama's import demand) but have been left in limbo due to a political scandal that caused the blend mandate to be scrapped indefinitely. For U.S. exports to Spain, the ethanol remains within a special trade zone for blending and then is sent to North Africa instead of fulfilling its own mandate.

Finally, the case of South Korea is still unclear and deserves continued monitoring. ITA decided to exclude South Korea from the 2015 Top Markets fuel ethanol ranking despite recently increased export activity. The records indicate that over 125 million liters (worth \$81 million) of U.S.-produced fuel ethanol was delivered to South Korea in 2014, compared to only 16 million liters the previous year and 29 million liters in 2012. This sudden surge has no easy

explanation, given that South Korea has no blend mandate and the public opinion is against ethanol from food crops. According to most industry observers, South Korea is only importing ethanol as an industrial chemical. It may be possible that undenatured ethanol for fuel use could be repurposed for bioplastics manufacturing, although there is a separate trade code for ethanol for non-beverage use.

Despite several exclusions from the rankings, and the downturn in U.S. exports to the EU, ITA identified twelve markets for this report. The countries near the top of the rankings are strong prospects. Those in the middle of the rankings are less predictable in the near term but still expected to be significant buyers of U.S. fuel ethanol. For countries towards the bottom of the rankings, such as China, Colombia, and the UK, any efforts made to increase exports will be an uphill battle, although some trade relationships already exist.

Figure 3: Other Notable Markets

Country	Reason for not including in rankings	2014 U.S. Fuel Ethanol Exports (L) – U.S. Census Data
South Korea	Majority is undenatured fuel-grade ethanol being used mainly as industrial ethanol (e.g., bioplastics)	125,493,900
Spain	Using Free Trade Zone; Not entering mainland for consumption	70,305,300
Nigeria	Ethanol is popular for special biofuels cooking stove program rather than blend mandate	38,251,700
Panama	Suspended the blend mandate; uncertain if/when will resume blending	7,993,500

## **Export Opportunities in the Near-Term**

Background information about ethanol production, consumption, import/export, and U.S. market share is detailed in the case studies for Canada, Brazil, the Philippines, India, and Mexico.

Each market is at various stages of development and levels of openness to U.S. exports. The Philippines, for example, has such an immediate need that U.S. producers should meet with active importers as soon as possible. Mexico, on the other hand, will see the liberalization of gasoline sales by 2017, so meeting with potential competitors to the government-owned monopoly PEMEX would be a more suitable approach.

India is a more complicated case, as the fuel ethanol exports are only indirectly contributing to the domestic 5 percent mandate. Indian policy prohibits the use of imports as fuel, but imports can backfill industrial use demand and free up more domestic supply for fuel use. Some policymakers would like to see a 10 percent

blend of ethanol. However, India's ethanol is produced from sugar cane, which can be subject to unpredictable fluctuations. More details about the ups and downs of India's biofuels policy environment are provided in the case study.

## Planning for the Long Term

The unpredictability of factors that affect U.S. ethanol exports – such as weather, prices, and exchange rates – should not deter long term strategic planning. As commercial scale "second generation ethanol" production gets off the ground in the United States, U.S. "conventional ethanol" producers will continue to look abroad for opportunities. Regardless, it will be an affordable option in countries that may not have the level of economic development necessary for either their own domestic production or to import expensive advanced ethanol.

















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